Table 2-5. Suction lysimeters installed at the Radioactive Waste Management Complex.

Lysimeter	Well	Date Installed	Lysimeter Depth (ft)	Cup Type
L01	W02[a]	June 14, 1985	14.0	Ceramic
L02	W03	June 17,1985	10.5	Ceramic
L03	W04	June 19,1985	24.5	Ceramic
L04	W04	June 19,1985	15.4	Ceramic
L05	W04	June 19, 1985	6.2	Ceramic
L06	w20	June 28,1985	6.7	Teflon
L07	W23	June 28, 1985	18.8	Teflon
L08	W23	June 28,1985	11.8	Ceramic
L09	W23	June 28, 1985	7.7	Ceramic
L10	T23	July 2, 1985	19.0	Teflon
L11	c02	July 3, 1985	4.3	Teflon
L12	W08	July 9, 1985	22.1	Ceramic
L13	W08	July 9, 1985	11.3	Ceramic
L14	W08	July 9, 1985	6.2	Ceramic
L15	PA01[b]	July 11, 1985	14.3	Ceramic
L16	PA02[b]	July 11, 1985	8.7	Ceramic
L17	TH02	June 7,1985	6.0	Ceramic
L18	TH04	April 23, 1985	4.0	Ceramic
L19	CO1	August 6, 1986	17.7	Ceramic
L20	CO1	August 6,1986	7.4	Ceramic
L21	TH05	September 8, 1986	15.2	Ceramic
L22	TH05	September 8, 1986	5.9	Ceramic
L23	W09	September 17, 1986	14.8	Ceramic
L24	W05	September 22, 1986	15.9	Ceramic
L25	W05	September 22, 1986	10.0	Ceramic
L26	W05	September 22, 1986	6.7	Ceramic
L27	W06	September 23, 1986	11.8	Ceramic
L28	W25	September 24, 1986	15.5	Ceramic
L29	W13	September 20, 1986	14.0	Ceramic
L30	W13	September 28, 1986	6.7	Ceramic
L31	W17	September 29, 1986	19.6	Ceramic
L32	W17	September 29, 1986	10.9	Ceramic

Table 2-5. (continued).

Lysimeter	Well	Date Installed	Lysimeter Depth (ft)	Cup Type
L33	PA03[b]	December 1994	10.0	Ceramic
L34	PA04[b]	December 1994	–27	Ceramic
L35	98-1	February 2,1998	16.5	Ceramic
L36	98-2	January 29,1998	9.0	Ceramic
L37	98-3	February 4,1998	22.5	Ceramic
L38	98-4	February 3,1998	17.0	Ceramic
L39	98-5	February 2,1998	10.5	Ceramic
L40	LYS-1	1994	6.6	Ceramic
L41	LYS-1	1994	19.7	Ceramic
DLO1	D06	September 12, 1986	88.0	Ceramic
DL02	D06	September 12, 1986	44.0	Ceramic
DL03	TW1	June 25,1987	226.9	Ceramic
DL04	TW1	June 25,1987	101.7	Ceramic
DL05	D15	September 15,1987	222.9	Ceramic
DL06	D15	September 15,1987	97.9	Ceramic
DL07	D15	November 4, 1987	32.2	Ceramic
DL08	I-ID	–November 1999	224	Stainless steel
DL09	I-1S	–November 1999	101	Stainless steel
DL10	I-2D	–November 1999	196	Stainless steel
DL11	1-2s	–November 1999	92	Stainless steel
DL12	I-3D	–November 1999	228	Stainless steel
DL13	I-3S	–November 1999	93	Stainless steel
DL14	I-4D	–January 2000	226.5	Stainless steel
DL15	I-4S	~January 2000	97	Stainless steel
DL16	I-5S	~March 2000	98.7	Stainless steel
DL17	O-1	December 16, 1999	228	Stainless steel
DL18	O-1	December 16, 1999	96	Stainless steel
DL19	0-2	January 12,2000	240	Stainless steel
DL20	0-2	January 12,2000	106	Stainless steel
DL21	0-3	November 1999	219	Stainless steel
DL22	0-3	November 1999	87	Stainless steel
DL23	0-4	January 4,2000	225	Stainless steel

Table 2-5. (continued).

Lysimeter	Well	Date Installed	Lysimeter Depth (ft)	Cup Type
DL24	O-4	January 4, 2000	108.5	Stainless steel
DL25	0-5	January 12, 2000	104	Stainless steel
DL26	0-6	November 1999	225	Stainless steel
DL27	0-7	November 1999	240	Stainless steel
DL28	0-7	November 1999	119	Stainless steel
DL29	0-8	–November 1999	228	Stainless steel

a. Lysimeters LO1 and W02 were inactivated after 1993 because they obstructed the construction phase of Pit 9 remediation activities.
b. Boreholes PA-01 and PA-02 were located in surficial sediment a couple of feet off the edge of the Pad A asphalt pad. The lithologic log for Borehole PA-03 does not indicate augering through the asphalt pad. The lysimeter in Borehole PA-04 was installed under the asphalt pad.

in boreholes, the naming nomenclature for the lysimeters relies on individual lysimeter numbers. Shallow lysimeters were installed in auger holes with a silica flour slurry surrounding the lysimeter cup. A 5- to 7-cm (2- to 3-in.) layer of bentonite was placed on top of the silica flour as a moisture seal and native sediments were used to backfill the borehole. Deep lysimeters in the B-C and C-D interbeds were installed in a silica flour slurry and bentonite was used to seal between instrument installations in the same borehole. A silica flour slurry with a 10-mg/L potassium bromide tracer was used for lysimeters installed in 1986 and 1987 to determine when valid samples were collected. The presence of the potassium bromide tracer in sample analysis would indicate that water applied during instrument installation is still affecting sample results, whereas absence of the tracer would indicate that the sample is representative of local soil moisture.

From November 1999 through March 2000, 22 deep lysimeters, DL08 through DL29, were installed inside and outside the SDA (Settle and Dooley 2002) (see Figure 2-14 and Table 2-5). The porous cups on these lysimeters are stainless steel with a -600 cm of water air entry pressure. Installation was similar to the procedure described above with silica flour slurry between layers of bentonite.

As part of remediation and monitoring activities for Pad A (Parsons 1995a, 1995b), two lysimeters were installed in December 1994. Lysimeter L33 was installed at a depth of 3 m (10 ft) below the surface of Pad A on the north side in Borehole PA-03 (see Figure 2-14). Pad A is an aboveground disposal area located on an asphalt pad. However, well logs indicate that drillers did not encounter the asphalt pad when augering Borehole PA-03; therefore, either the asphalt pad does not extend as far as Borehole PA-03 or the lysimeter is located in cover material above the asphalt pad. Lysimeter L34 was installed in a horizontal borehole under the asphalt at Pad A in Borehole PA-04. Lysimeter **L34** is located near the center of Pad A, approximately 50 m (165 ft) northeast of the Borehole PA-04 wellhead. Both lysimeters were installed in silica flour and bentonite was used to seal the silica flour layer.

Five lysimeters, L35 through L39, were installed in surficial sediments in the SDA in 1998 to assess magnesium chloride migration in soil at the SDA (see Figure 2-14 and Table 2-5). Magnesium chloride was applied to SDA roads to suppress dust in 1984, 1985, and in the early 1990s, and the chloride might contribute to the corrosion of buried waste containers. Each of the lysimeters was installed as close as possible to the sediment-basalt interface. A soil slurry was placed around the porous ceramic cup, native soil was used to backfill the borehole, and a 30-cm (1-ft) layer of bentonite was placed 51 cm (2 ft) above the instrument to serve as a barrier to downhole water movement.

Suction Lysimeters L40 and L41 were installed in 1994 to collect water samples near buried beryllium blocks near the west end of Soil Vault Row (SVR)-20 to validate calculated beryllium corrosion and radionuclide release rates used in low-level waste operations performance assessments (Case et al. 2000). Lysimeter cups were placed in native fill material with a layer of sand above and below the lysimeter, and the borehole was backfilled with bentonite. Several attempts were made to collect a sample from L40, but a sufficient vacuum to collect a sample could not be maintained. However, the deeper lysimeter, L41, yielded sufficient sample volume to analyze for chloride, C-14, and tritium (Ritter and McElroy 1999).

2.3.3 Tracer Studies

A tracer study was conducted at Spreading Areas A and B by the USGS and an additional tracer test is planned for the Big Lost River and the Spreading Areas when water accumulation in the Spreading Areas is sufficient. A tracer study within the SDA began in 2001. The goal of these tracer studies is to quantify the influence of the spreading areas on perched water beneath the SDA and the influence of surficial infiltration on contaminant fate and transport at the RWMC. Each tracer test is summarized below.

2.3.3.1 U.S. Geological Survey Spreading Area Tracer Test. A tracer test was conducted at two of the four spreading areas near the SDA to investigate long-range flow paths through the vadose zone (Nimmo et al. 2002). The four spreading areas receive water from the Big Lost River as a diversion during periods of high surface water flow. Rarely are all four spreading areas used in a given season. In some years no diversions are necessary and all the spreading areas remain dry.

In June 1999, the USGS applied a 1,5-naphthalene disulfonic acid tracer to Spreading Areas A and B (Nimmo et al. 2002). The tracer was a dry powder that was placed in a sack and was introduced into the spreading area water by towing the sack in the water behind a boat. The boat traversed the accessible wet areas of Spreading Areas A and B on the first day, towing the sack of tracer through the water. Using the same method on the second day, the tracer was again introduced into Spreading Area B in the lobe that extends north toward the SDA (see Figure 2-15). Key findings of the tracer test are listed below:

- Low permeability layers of the unsaturated zone (i.e., interbeds) divert some flow horizontally
- Horizontal movement does not prevent rapid transport to the aquifer under ponded conditions at the surface, as indicated by detection of the tracer in Aquifer Well USGS-120 within 9 days
- Because tracer was detected in perched water at Well USGS-92, some perched water beneath the SDA is contributed by spreading area water from more than 1 km (3,280 ft) away
- The tracer in USGS-92 was detected within 90 days and may have arrived sooner, indicating that horizontal convective transport rates within the unsaturated zone exceed 14 m/day (46 ft/day)
- Napthalene sulfonates are useful tracers to investigate flow paths over distances of more than 1 km (3,280 ft) and over a period of several months.

2.3.3.2 Subsurface Disposal Area Tracer Study. The primary purpose of the SDA tracer study is to assess water movement from the surface downward through the soil cover and the underlying waste and into underlying vadose zone where perched water forms. The secondary purpose of the SDA tracer study is to help assess the groundwater flow direction in the aquifer beneath the RWMC. The three objectives of the SDA tracer study are to assess the following:

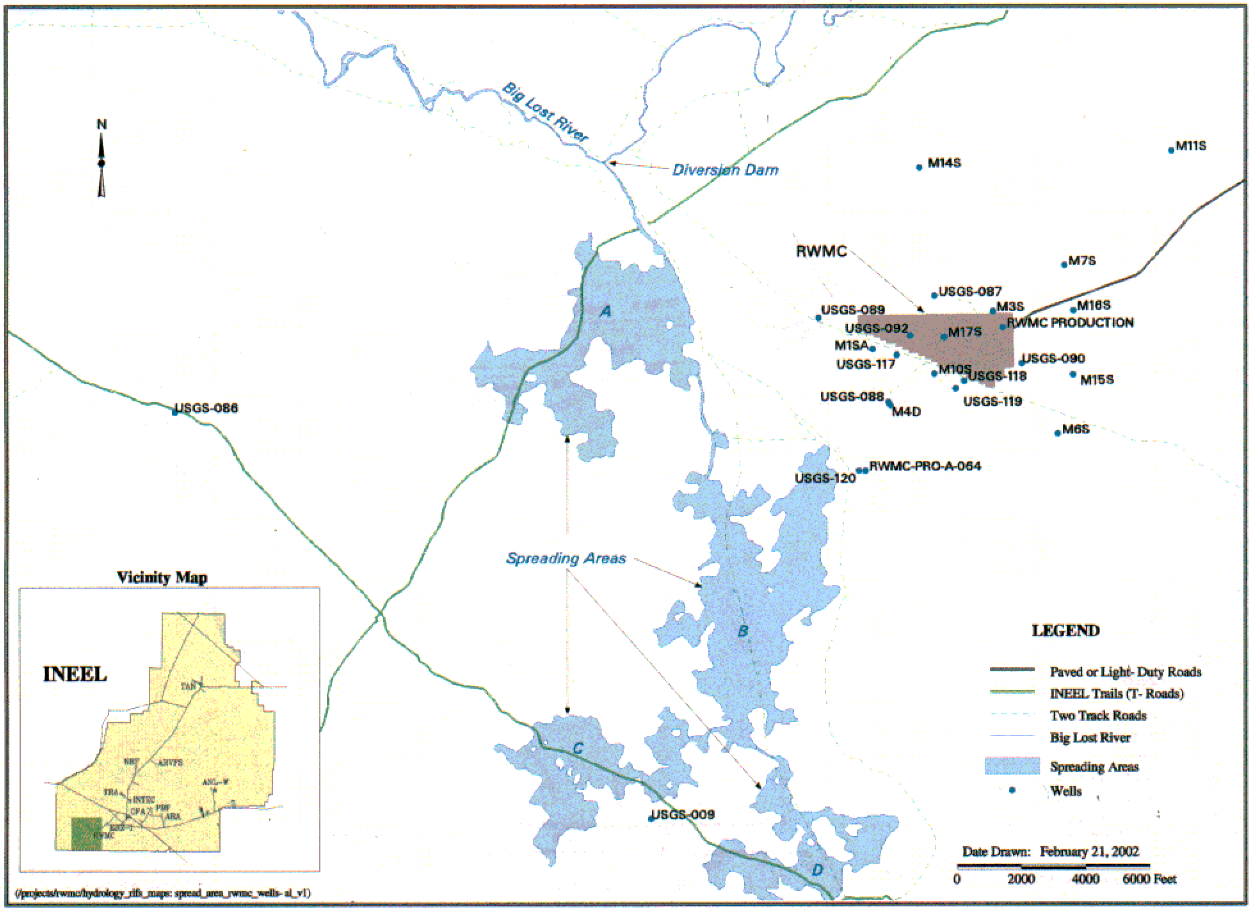

Figure 2-15. Location of surface water features and select monitoring wells near the Radioactive Waste Management Complex.

- Whether dyes can be traced from near-surface locations through buried waste and into underlying perched water and aquifer and to characterize travel rates to locations where the dyes are detected
- Whether dyes can be traced from near-surface locations in areas within the SDA where water is occasionally ponded and to characterize travel rates to all sites where the dyes may be detected
- The directions of groundwater flow and travel rates within the aquifer beneath the RWMC.

The SDA tracer study tests began in March 2001 when four different fluorescent dyes were introduced into the following areas inside of and south and east of the SDA (see Figure 2-16):

- Rhodamine-WT dye was placed in aquifer Well M17S, inside the SDA
- Eosine dye was placed in the drainage ditches around the waste pits inside the SDA
- Pyranine dye was placed in 76-cm (30-in.) deep holes over the waste pits in the SDA
- Sulforhodamine-B dye was placed in the perimeter drainage channel south and east of the SDA.

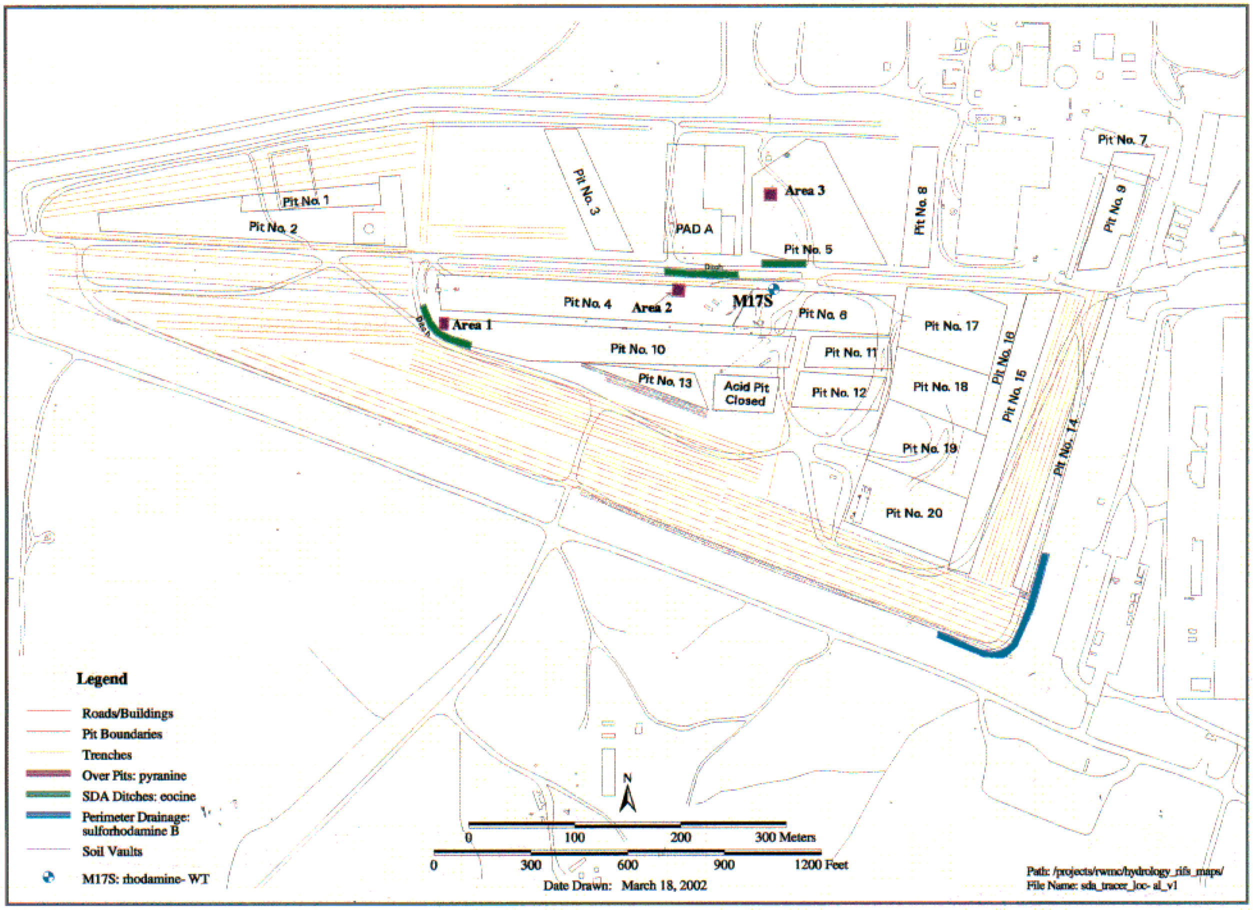

Figure *2-16.* Locations where tracer dye has been introduced at the Subsurface Disposal Area.

Lysimeter and aquifer wells in and around the RWMC are currently being monitored for these However, no samples from the lysimeters have been analyzed for tracers during the last four quarters because of insufficient sample volume.

Tracer analysis results for Rhodamine-WT dye placed in Well M17S indicate that concentrations have decreased slowly, in spite of the fact that each of the six times that the well has been sampled, three bore volumes (three times the volume of the well casing from the water table to the surface) of water were purged from the well. An inference that can be drawn from this negligible decline is that water velocities in the immediate vicinity of this well are very small. Analyses of the tracer decline are planned for ongoing aquifer monitoring to estimate local aquifer velocity. Low groundwater velocities implied from the tracer test at Well M17S substantiate the presence of a low-permeability region as inferred from single well pump tests in the area.

2.3.3.3 ***Big Lost River and Spreading Area Tracer Studies.*** The Big Lost River system tracer studies are being performed to *identify* and quantify the influence of the system on the subsurface water flow and contaminant transport at the RWMC. Surface water infiltrates and moves laterally through the vadose zone from the spreading areas, as demonstrated by the USGS tracer test (see Section 2.3.3.1). Water from the Big Lost River may have a similar influence. The objective of the tracer studies is to quantify the influence of the Big Lost River system on hydrologic characteristics and behavior beneath the RWMC. Analysis of the test results would be used to assess the following issues:

- Whether water from the spreading areas and the Big Lost River is moving through the vadose zone and affecting subsurface hydrology near the RWMC

- Contribution of the spreading areas and the Big Lost River to perched water volumes in the RWMC subsurface

- Identification of which areas in the water system are influencing the RWMC subsurface and in what proportions

- Because of the lack of snow pack and precipitation during the winter of 2000 and 2001, no new water flowed into the Big Lost River or the spreading areas during the spring and summer of 2001. Therefore, no tracers were added to those areas in 2001, and the tracer test was rescheduled for 2002, contingent on sufficient abundance of water in the system.

2.3.4 Effects of Upgradient Aquifer Plumes on the Radioactive Waste Management Complex

The sparse water level measurements between the RWMC and facilities to the northeast (i.e., INTEC, TRA, and CFA) have been interpolated to extrapolate water table contours. Though the RWMC is generally downgradient from INTEC, TRA, and CFA, it is uncertain whether the RWMC lies within the flow path for contaminants that have entered the aquifer from those facilities. The potential impact of upgradient contaminant plumes on water quality in the SRPA beneath the RWMC was evaluated by examining aquifer data for 1-129, H-3, Sr-90, and chloride.

2.3.4.1 Impact of I-129 Plume. Recent groundwater sampling results indicate that an 1-129 plume extends from INTEC into the CFA area (DOE-ID 2002). The highest 1-129 concentrations were detected in two wells at the CFA landfills (see Figure 2-17). Only two wells, LF 3-8 and LF 2-8, had 1-129 concentrations that exceeded the maximum contaminant level (MCL) of 1 pCi/L (DOE-ID 2002). In contrast, 1-129 was more than 1 pCi/L in 12 wells in the groundwater sampling conducted by the USGS in 1991 (Mann and Beasley 1994). Recent sampling data and USGS sampling data from 1991 indicate that the centerline of the INTEC 1-129 plume runs primarily south. The plume boundary is well-defined in the south by the CFA MON wells, but the westerly extension is estimated. Therefore, the influence of the INTEC 1-129 plume at the RWMC has not been ascertained at the current detection limit of 1 pCi/L. ***An*** analysis capable of achieving a detection limit as low as 0.1 pCi/L for 1-129 could be used for future monitoring of the groundwater beneath the new INTEC percolation ponds and the RWMC to determine if the INTEC plume affects the aquifer in the RWMC area.

2.3.4.2 Impact of H-3 Plume. Because of the large areas without wells between RWMC, TRA, and INTEC, the tritium plume delineation for the three facilities is not definitive. The tritium concentration contours illustrated in Figure 2-18 suggest that the tritium plume at the RWMC is separate from the INTEC and TRA tritium plumes. However, the odd shape of the tritium plume south of CFA in the vicinity of the CFA-MON wells and Well USGS-83 could be caused by the INTEC and TRA plumes merging or by undefined heterogeneities in the aquifer.

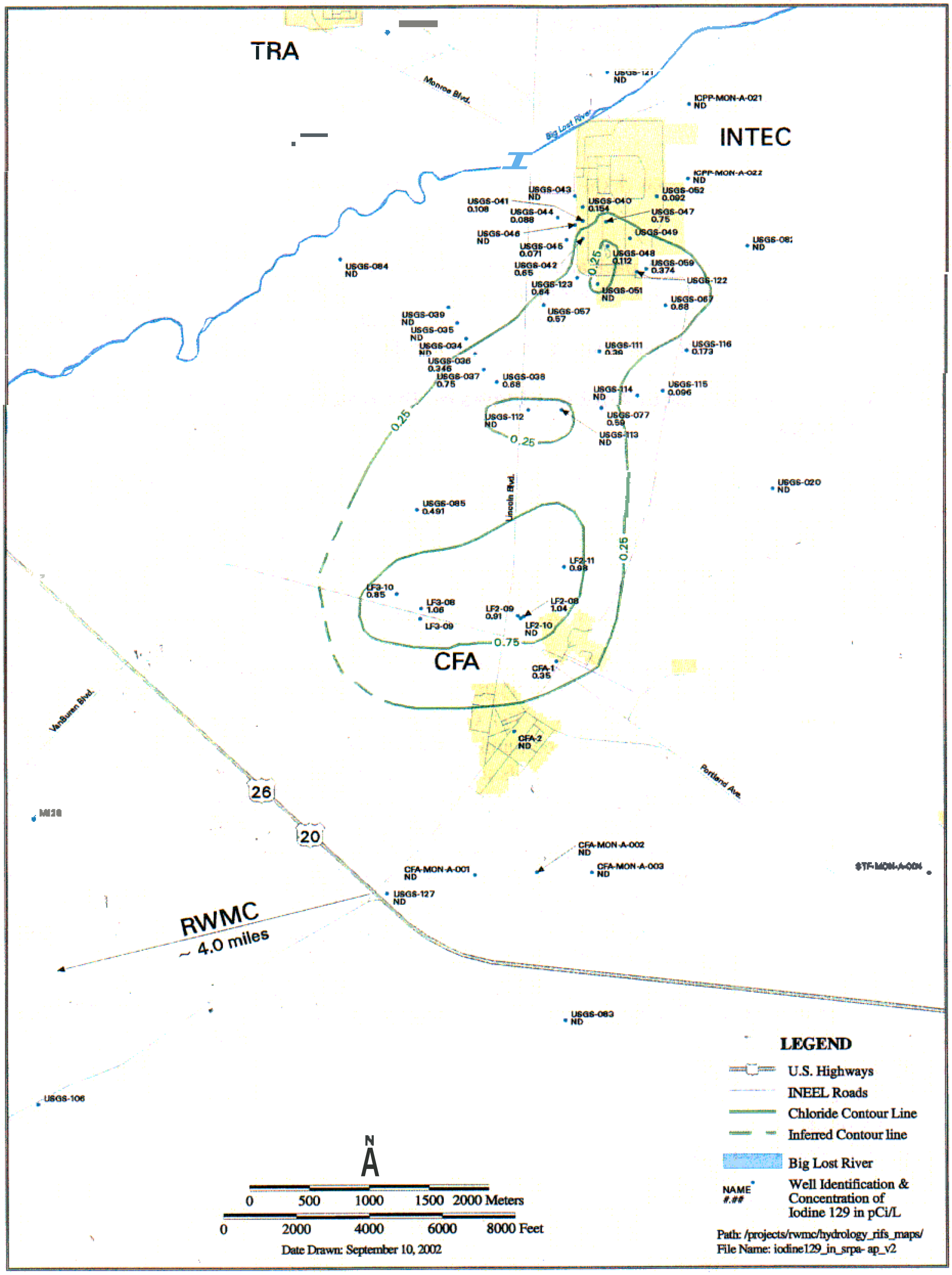

Figure 2-17. Distribution of idme-129 in 2001 in the Snake Rive Plain Aquifer in the areas of the Idaho Nuclear Technology and Engineering Center and Central Facility Area.

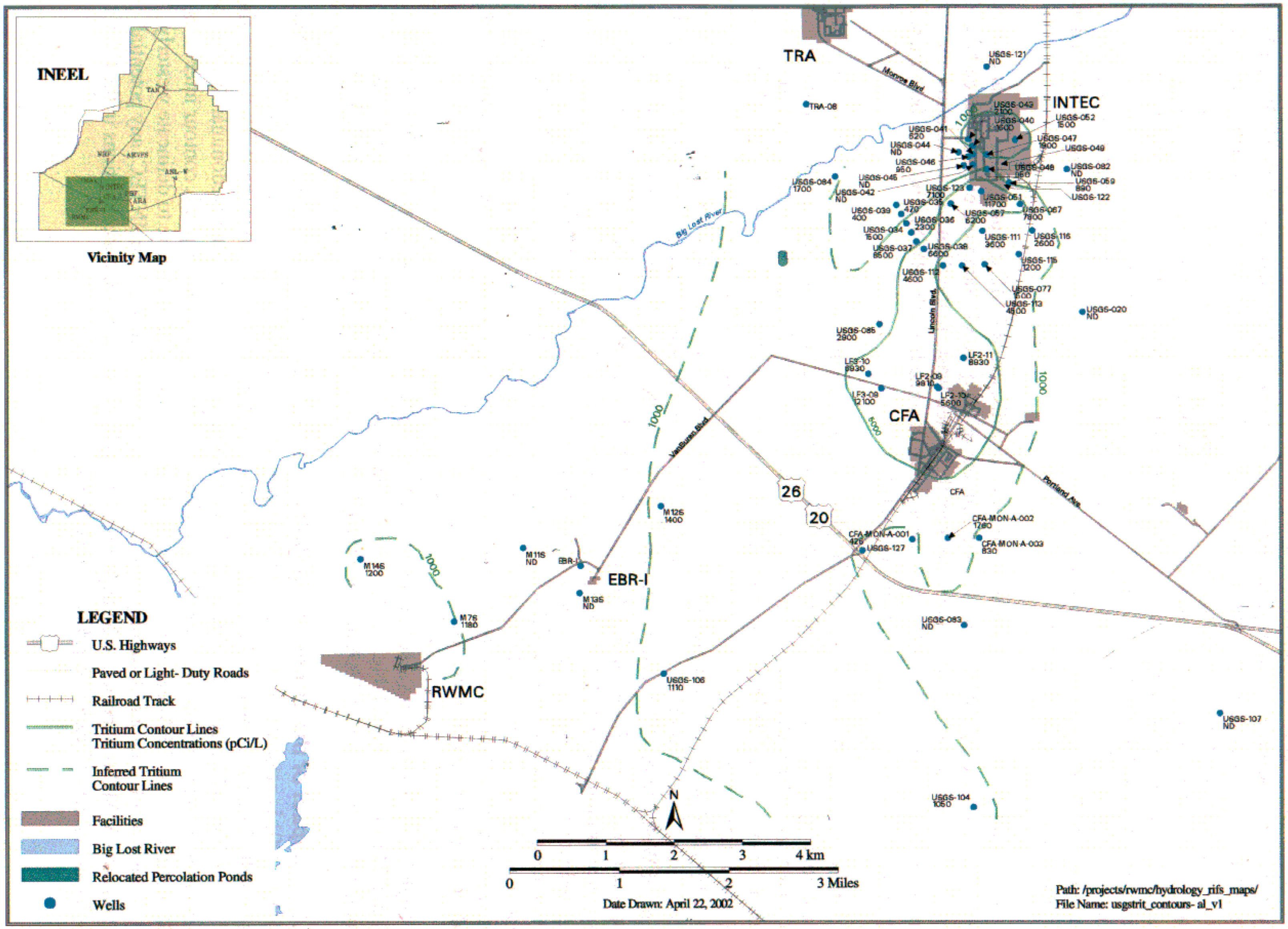

Figure 2-18. Distribution of tritium in 2000 in the Snake River Plain Aquifer.

Three lines of evidence indicate that the RWMC tritium plume is separate from the INTEC and TRA plumes. First, samples from aquifer Wells EBR-1, M11S, and M13S always yield either nondetects or show very low concentrations of tritium. These three wells are located between Wells M12S and M14S that consistently show tritium concentrations of 1,000 to 2,000 pCi/L. Nondetects documented in Wells EBR-1, M11S, and M13S provide strong evidence indicating the presence of two distinct tritium plumes, one from RWMC and a combined plume from TRA and INTEC. It is important to note that Wells M11S, M12S, M13S, and M14S are completed with screens at a depth of 6.1 m (20 ft) into the aquifer. Well EBR-1, however, is screened from 182.9 to 228.6 m (600 to 750) ft below ground surface and is an open borehole from 228.6 to 327.7 m (750 to 1,075 ft) below ground surface. The pump in EBR-1 is set at 254.7 m (835.5 ft) below ground surface or about 70.1 (230 ft) into the aquifer and is, thus, monitored at greater depths than the other three wells.

The second line of evidence indicating presence of a discrete RWMC tritium plume is that carbon tetrachloride has been detected in Well M14S in four out of six quarterly sampling events. The carbon tetrachloride concentrations probably emanate from the buried waste in the SDA. By association, the concentration of tritium in Well M14S also is likely to have come from the RWMC because both carbon tetrachloride and tritium can migrate in the vapor phase.

A third line of evidence that the RWMC plume has not merged with the INTEC and TRA plume is the distribution of chloride concentrations in the SRPA. In contrast to tritium, which could originate from INTEC, TRA, or the RWMC, chloride disposal was unique to INTEC. Data, primarily from USGS monitoring from April to October 2000, were used to construct a chloride plume map (Figure 2-19). The tritium and chloride plume maps indicate that Wells CFA-MON-A-002 and CFA-MON-A-003 have been impacted by contamination of chloride migrating from INTEC while Well CFA-MON-A-001 in the same vicinity has not. Though chloride results are not available, tritium was below detection limits in a recent sampling of Well USGS-127, located to the west of CFA-MON-A-001, suggesting that this well also is not impacted by the INTEC plume. In addition, Wells USGS-84, USGS-106, and M12S have yielded tritium concentrations of more than 1,000 pCi/L, but the chloride levels in these wells are consistent with background values, suggesting that the source of tritium in these wells is not the INTEC. The source of tritium in these three wells could be TRA because tritium migrating from TRA does not have chloride associated with it. Monitoring wells are now available at the Vadose Zone Research Park, the site of the relocated INTEC percolation ponds (see Figure 2-18), and these wells could be sampled for tritium and chloride to help refine this hypothesis.

High levels of sulfate are associated with TRA, but sulfate data from wells such as M11S, M12S, M14S, and M13S are not available. Analysis for sulfate in wells located in the RWMC could aid in the determination of the impact of TRA on contaminant concentrations in the aquifer near the RWMC.

2.3.4.3 Impact of the Strontium-90 Plume. A contour map of the Sr-90 plume around INTEC and CFA in 2001 is presented in Figure 2-20. A large amount of Sr-90 was disposed of in the INTEC injection well (formerly known as the Chemical Processing Plant injection well) in the 1950s through the early 1980s (DOE-ID 2000a). The centerline of the plume appears to be west and predominantly south of CFA, rather than to the west toward the RWMC. The southerly extent of the 1-pCi/L contour interval is partially defined by the CFA-area wells. However, well coverage is not adequate to delineate westerly spread of the 1-pCi/L contour. Assuming that the RWMC is downgradient from INTEC, any potential impact on the RWMC is expected to be negligible because of the low Sr-90 concentrations in the CFA area wells and effects of decay, dispersion, and dilution.

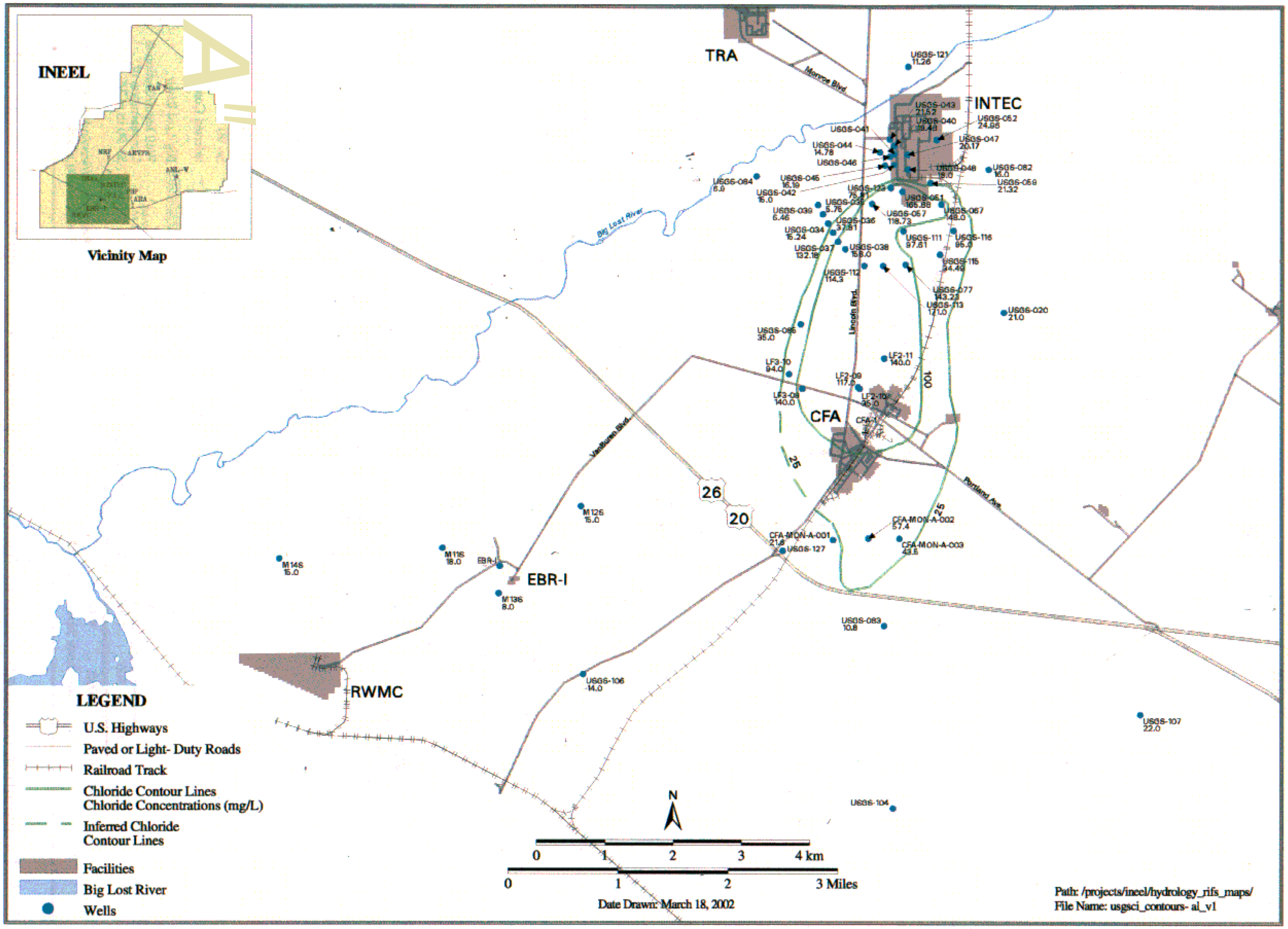

Figure 19. Distribution of chloride in 2000 in the Snake River Plain Aquifer.

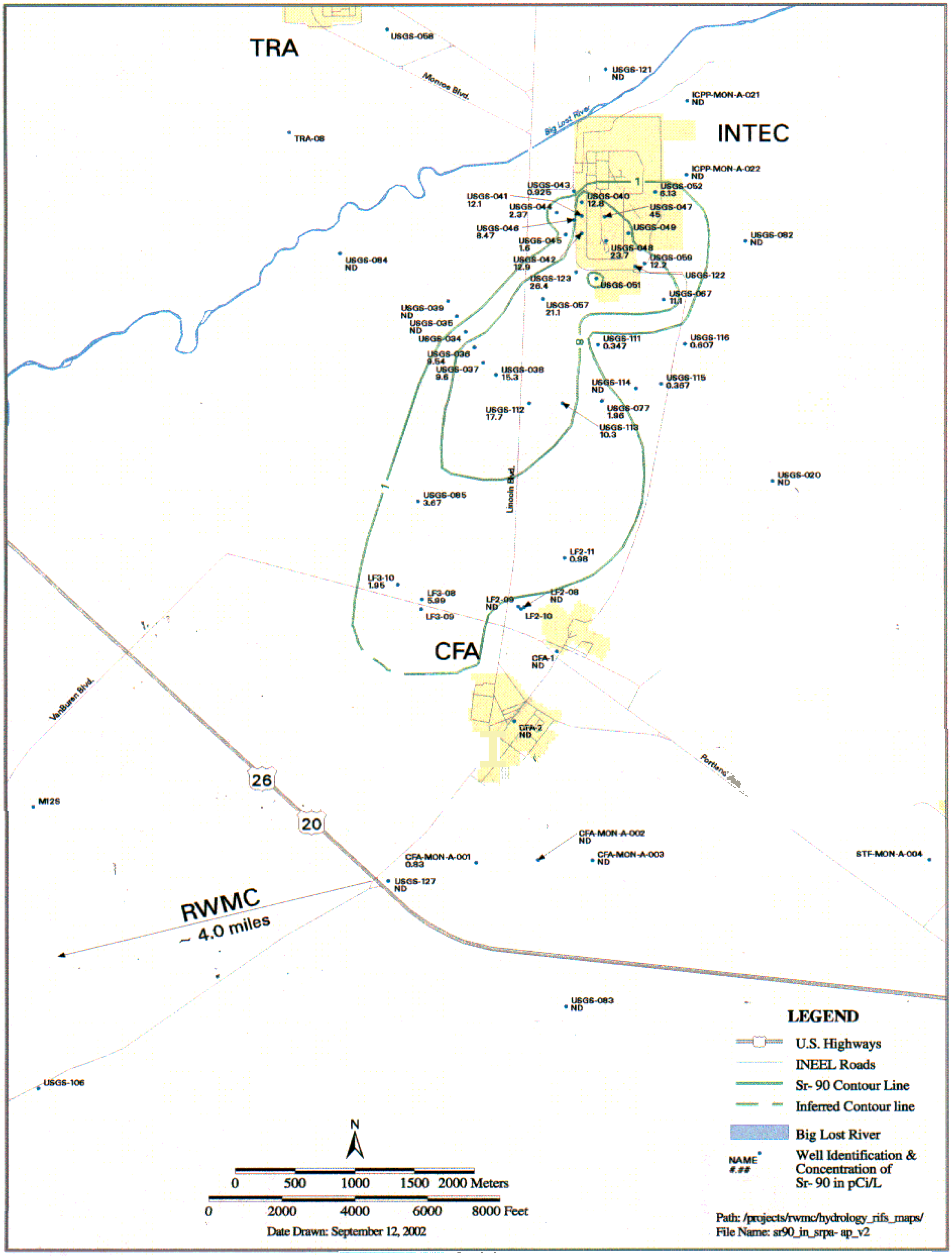

Figure 2-20. Distribution of strontium-90 in 2001 in the Snake River Plain Aquifer in the areas of the Idaho Nuclear Technology and Engineering Center and Central Facilities Area:-

2.3.4.4 Summary. A substantial and growing body of evidence indicates that the SRPA beneath the RWMC is not influenced by contaminants introduced into the aquifer at INTEC or TRA. Current information indicates that the RWMC is sufficiently west to be off-gradient and outside of plumes emanating from INTEC or TRA. This interpretation could be verified by sampling wells in the RWMC area and at the new INTEC percolation ponds for 1-129 using a low-level detection method as an indicator of contamination from INTEC and for sulfate as a possible indicator of contamination from TRA.

2.4 Flora and Fauna

A large percentage of the INEEL site is undeveloped land. The original intent for obtaining this expanse of land was to provide a large safety and security buffer between the facility areas within the Site and between INEEL operations and non-INEEL lands. The general open space at the INEEL still serves this function today. In addition, undeveloped land and its restricted access provide an important habitat for plants and animals and refuge for wildlife. Large numbers of migratory birds of prey and mammals are funneled on to the INEEL because of its location at the mouth of several mountain valleys.

The central core of the Site may constitute the largest area of undeveloped and ungrazed sagebrush steppe outside of national park lands in the Intermountain West. In recognition of the importance of this undisturbed area as an ecological field laboratory, DOE designated the INEEL as a National Environmental Research Park in 1975 (Bowman et al. 1984; Stoller 2002). On July 17, 1999, DOE, the U.S. Fish and Wildlife Service, the Idaho Department of Fish and Game (IDFG), and the BLM created the Sagebrush Steppe Ecosystem Reserve (INEEL 1999). This reserve comprises 74,000 acres of unique habitat in the northwest portion of the INEEL. This sagebrush environment has a high value to a wide range of wildlife.

Six broad vegetation categories representing nearly 20 distinct habitats have been identified on the INEEL: juniper-woodland, native grassland, shrub-steppe off lava, shrub-steppe on lava, modified lands, and wetlands. Nearly 90% of the Site is covered by shrub-steppe vegetation, which is dominated by big sagebrush, saltbush, rabbitbrush, and native grasses (INEEL 2001b). In addition to the predominant sagebrush steppe communities, small riparian and wetland regions are located along the Big Lost River and Birch Creek and have been identified as sensitive biological resource areas within the Site. A comprehensive list of plant species found on the INEEL is available on the INEEL Environmental Surveillance and Research Program website (Stoller 2002a).

More than 200 vertebrate species including 37 mammals, 159 birds, nine reptiles, five fish, and one amphibian have been observed within the Site boundaries (Stoller 2002a). During some years, hundreds of birds of prey and thousands of pronghorn and sage grouse winter at the INEEL. Mule deer and elk also reside at the Site. Observed predators include bobcats, mountain lions, badgers, and coyotes. A comprehensive list of animal species found on the INEEL is available on the INEEL Environmental Surveillance and Research Program website (Stoller 2002a). Bald eagles, classified as a threatened species, are commonly observed at or near the Site each winter. Peregrine falcons, which were recently removed from the federal endangered list, also have been observed within the Site boundaries. In addition, several other species of concern, including the pygmy rabbit, ferruginous hawk, Townsend's big-eared bat, burrowing owl, and loggerhead shrike may either inhabit or migrate through the area. A number of these species are currently being studied at the INEEL. Threatened and endangered species and other species of concern that may be found on the INEEL are listed on Table 6-11 and discussed in detail in Section 6.6.2.2.

The flora and fauna at the RWMC are representative of the species found across the INEEL. Sagebrush-steppe on lava communities with dominant sagebrush and rabbitbrush vegetation make up nearly 90% of the natural cover at WAG 7. Most of the waste disposal areas within the SDA have been seeded with grass and are kept mowed. Fauna potentially present at RWMC are those species supported by the various vegetation communities that exist at and around the facility. Though not all species have been observed at the RWMC, nearly all avian, reptile, and mammalian species found across the INEEL also could be found at the RWMC. Larger mammals such as coyotes and antelope are generally excluded from the SDA and other facility structures by fences, but are occasionally seen on facility grounds. Burrowing rodents such as ground squirrels, voles, and mice, and insects such as the harvester ant are common RWMC inhabitants. No ecologically sensitive areas (i.e., areas of critical habitat) have been identified within RWMC.

2.5 Demography

Populations potentially affected by INEEL activities include INEEL employees, ranchers who graze livestock in areas on or near the INEEL, hunters on or near the Site, residential populations in neighboring communities, travelers along U.S. Highway 20/26, and visitors at the EBR-I. As a component of the INEEL, the RWMC area has the same general demographic surroundings.

2.5.1 On-Site Populations

Nine separate facilities at the INEEL include a total of approximately 450 buildings and more than 2,000 other support facilities. The INEEL employed 7,303 contractor and government personnel as of December 2001."Approximately 40% of the total work force is located in Idaho Falls, Idaho, and 60% are employed at the INEEL Site location about 80 km (50 mi) west in the Arco Desert. As of December 2001, the total INEEL work force included 3,653 employees at Site locations (879 employees at INTEC, 837 at CFA, 751 at the NRF, 423 at TRA, 352 at TAN, 308 at the RWMC, and 103 at the Power Burst Facility); 2,454 employees in Idaho Falls occupying numerous offices, research laboratories, and support facilities; 26 employees at off-Site locations; 698 DOE-Chicago employees at ANL-W; 368 DOE-ID employees in Idaho Falls and at the Site; and 104 British Nuclear Fuels (BNFL)[b] Advanced Mixed Waste Treatment Facility (AMWTF) employees at the RWMC and in Idaho Falls. Authorized groups and visitors occasionally are escorted at the RWMC. Subcontracted employees and personnel from IDEQ and EPA oversight programs also visit the area.

2.5.2 Off-Site Populations

The INEEL is bordered by five Idaho counties: Bingham, Bonneville, Butte, Clark, and Jefferson (see Figure 2-21). Major communities include Blackfoot and Shelley in Bingham County, Idaho Falls and Ammon in Bonneville County, Arco in Butte County, and Rigby in Jefferson County. Population estimates for the counties surrounding the INEEL and the largest population centers in these counties are shown in Table 2-6 (Census 2001). The community nearest to the INEEL is Atomic City, Idaho, located south of the Site boundary on U.S. Highway 20/26. Other population centers near the INEEL include Arco, 11 km (7 mi) west of the Site; Howe, west of the Site on U.S. Highway 22/33; and Mud Lake and Terreton on the northeast border of the Site. The INEEL supports no permanent residents (Hull 1989).

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a. Martin, Lynette T., 2001, INEEL Headcount Report, Idaho National Engineering and Environmental Laboratory, Bechtel BWXT Idaho, LLC, Idaho Falls, Idaho, December 23, 2001.

b. BNFL Inc. **is** the wholly owned subsidiary of British Nuclear Fuels and is responsible for the company's nuclear cleanup based in the United States.

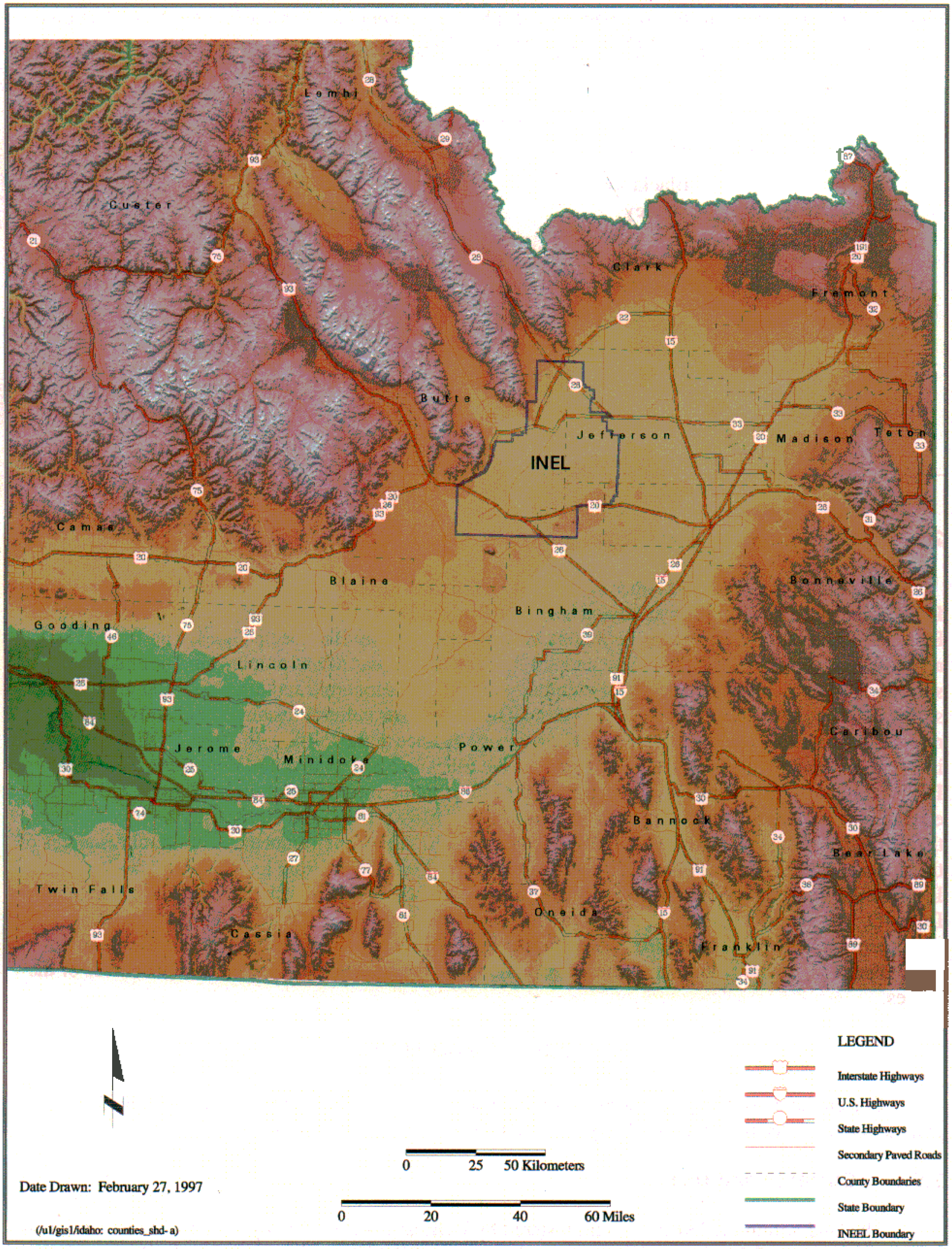

Figure 2-21. Counties adjacent to the Idaho National Engineering and Environmental Laboratory.

Table **2-6.** Population estimates for counties and selected communities surrounding the Idaho National Engineering and Environmental Laboratory (Census **2001).**

Location	Population Estimate
Bingham County	**41,735**
Blackfoot	**10,419**
Shelley	**3,813**
Clark County	**1,022**
Bonneville County	**82,522**
Ammon	**6,187**
Idaho Falls	**50,730**
Butte County	**2,899**
Jefferson County	**19,155**
Rigby	**2,998**

2.5.3 Shoshone-Bannock Tribal Interests

The Shoshone-Bannock Tribes of the Fort Hall Indian Reservation are a federally recognized Indian tribe and a sovereign government. The Fort Bridger Treaty of July **3, 1868,** Stat. **673,** secured the Fort Hall Reservation as the permanent homeland of the Shoshone-Bannock peoples. The **1868** Treaty also reserved aboriginal rights to these peoples that extend to areas of unoccupied land in Idaho and surrounding states, allowing access for cultural, political, and economic activities essential to the Tribes survival. Though the INEEL is occupied land, DOE-ID protects cultural resources and allows tribal members access to areas of cultural and religious significance at the INEEL. In **1994,** DOE-ID entered into a Memorandum of Agreement that provides the tribes free access to the Middle Butte area of the INEEL. Other INEEL areas may be identified for access in the future for cultural, religious and educational activities. Agreement-In-Principals (DOE-ID **1992, 1998,** and **2002)** with the tribes assure that activities being conducted a the INEEL protect health, safety, environment and cultural resources of the tribes and address tribal interests in DOE-administered programs. From its inception, the Agreement-In-Principal has been updated periodically to maintain a working relationship between the Tribes and DOE-ID. Therefore, it is likely that future INEEL activities will include Tribal support to avoid endangering the Tribe's environment or impairing their ability to protect health, welfare, and safety of tribal members, others within the Tribes' jurisdiction, and the environment and cultural resources of the Tribes.

2.6 Land Use

Current land use and projections for future land use are summarized below for the INEEL in general and then, as indicated in subsequent headings, for the RWMC specifically.

2.6.1 Current Land Use

The land within the INEEL is administered by DOE and is classified by the BLM as industrial and mixed-use acreage (DOE **1991).** The current primary use of INEEL land is to support facility and program objectives. Current INEEL activities emphasize spent nuclear fuel management, hazardous and mixed waste management and minimization, cultural resources preservation, and environmental engineering, protection, remediation, and long-term stewardship (DOE-ID 1996). The laboratory's future mission includes delivering science-based solutions to the current challenges of DOE, other federal agencies, and industrial clients, completing environment cleanups responsibility, and maintaining the scientific and technical talent, facilities, and equipment to best serve national and regional interests (INEEL 2002). Large tracts of land are reserved as buffer and safety zones around the boundary of the INEEL while portions within the central area are reserved for INEEL operations. The remaining land within the core of the reservation, which is largely undeveloped, is used for environmental research and to preserve ecological and cultural resources.

The perimeter buffer consists of 1,295 km^2 (500 mi^2) of grazing land (DOE 1991) administered by the BLM (see Figure 2-22). Grazing areas at the INEEL, which are shown in Figure 2-22, support cattle and sheep, especially during dry conditions. Depredation hunts of game animals managed by the Idaho Department of Fish and Game are permitted on the Site within the buffer zone during selected years. Hunters are allowed access to an area that extends 0.8 km (0.5 mi) inside the INEEL boundary on portions of the northeastern and western borders of the Site (Becker et al. 1996).

State Highways 22, 28, and 33 traverse the northeastern portion of the Site, and U.S. Highways 20 and 26 traverse the southern portion (see Figure 2-21). One hundred forty-five km (90 mi) of paved highways used by the general public pass through the INEEL (DOE 1991), and 23 km (14 mi) of Union Pacific Railroad tracks traverse the southern portion of the Site. A government-owned railroad, a spur of the Union Pacific railroad, passes through CFA to INTEC and terminates at NRF. A second spur runs from the Union Pacific railroad to the RWMC.

In the counties surrounding the INEEL, approximately 45% of the land is used for agriculture, 45% is undeveloped land, and 10% is urban (INEEL 2001b). Livestock produced on land surrounding the INEEL includes sheep, cattle and dairy cattle, hogs, and poultry (Bowman et al. 1984). The major crops produced on the surrounding lands include wheat, alfalfa, barley, potatoes, oats, and corn. Sugar beets are grown within about 40 mi of the INEEL in the vicinity of Rockford, Idaho, southeast of the INEEL in central Bingham County (see Table 2-7). Land ownership around the INEEL is illustrated in Figure 2-22. Most of the land immediately adjacent to the INEEL is owned by the U.S. government.

Table 2-7. Acreage by county of major crops harvested on land surrounding INEEL, 1999 to 2000 (Idaho 2000).

County	Wheat	Alfalfa	Barley	Potatoes	Sugar Beets	Oats	Silage Corn
Bingham	131,000	52,300	22,500	63,600	21,900	600	1,800
Bonneville	63,900	34,000	60,500	31,800	—	700	—
Butte	6,900	29,000	16,300	2,500	—	200	—
Clark	21,700	21,100	2,800	—	—	100	—
Jefferson	36,700	98,400	48,800	29,900	—	500	3,600

Note: The dash indicates little or no production.

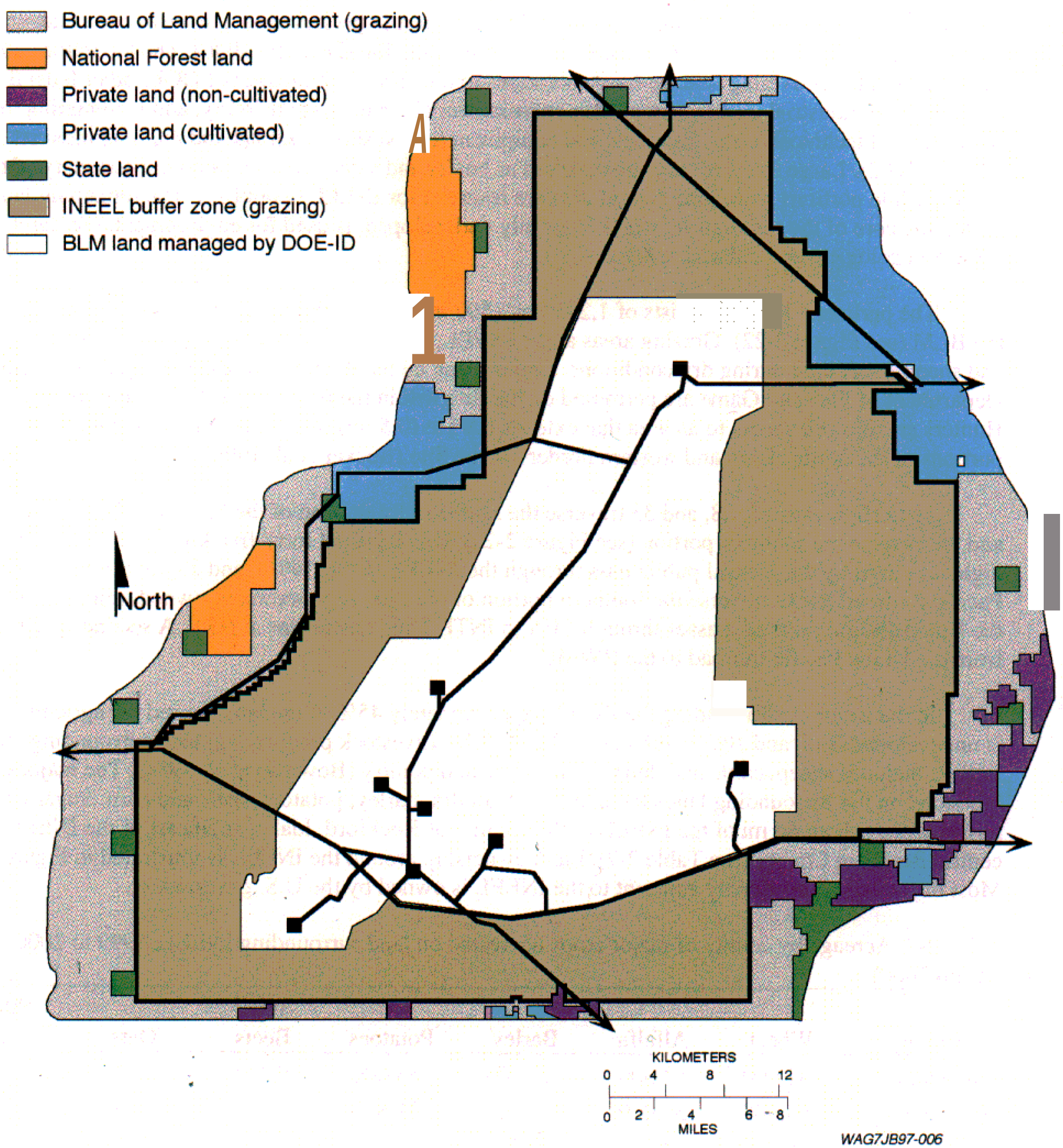

Figure 2-22. Land ownership distribution in the vicinity of the Idaho National Engineering and Environmental Laboratory.

2.6.1.1 Future Land Use. Future land use is addressed in the INEEL Long-Term Land Use Future Scenarios document (DOE-ID 1995), the Comprehensive Facility and Land Use Plan (INEEL 2001b), and in the Infrastructure Long-Range Plan (INEEL 2001a). Because future land-use scenarios are uncertain, assumptions were made in the INEEL Long-Term Land Use Future Scenarios document for defining factors such as development pressure, advances in research and technology, and ownership patterns, The following assumptions were applied to develop forecasts for land use within the INEEL:

- The INEEL will remain under government ownership and control for at least the next 100 years. The boundary is currently static, but may shrink in the future. Portions of the INEEL will be managed beyond 100 years under the long-term stewardship program currently under development.

- Life expectancy of current and new facilities is expected to range between 30 and 50 years. Decontamination and dismantlement will commence following closure of each facility if new missions for the facility are not determined.

- No residential development (e.g., housing) will occur within the INEEL boundaries within 100 years.

- No new major, private developments (residential or nonresidential) are expected in areas adjacent to the INEEL.

Future land use most likely will remain essentially the same as the current use—a research facility within the INEEL boundaries with agriculture and undeveloped land surrounding the INEEL. Other potential but less likely land uses within the INEEL include agriculture and the return of Site lands to their undeveloped state.

2.6.2 Radioactive Waste Management Complex Current and Future Land Use

Land use at the RWMC is limited to industrial applications. Continued waste management operations and associated expansion is expected to continue at the RWMC. According to land use projections, expansion is not expected to require any land outside of the current boundaries of the facility (INEEL 2001b). However, as discussed below, expanding local land use may be necessary around the RWMC to accommodate operations in the TSA and to implement remedial actions in the SDA.

Dedicated to the temporary storage of contact- and remote-handled solid TRU waste, TSA is contained within a security fence. Facilities at TSA include the Stored Waste Examination Pilot Plant, the Air Support Weather Shield, the Drum Venting Facility where filters are installed in the lids of waste drums to prevent hydrogen buildup, a maintenance shop, the Transuranic Package Transporter Loading Station, Type I and Type II Storage Modules, and the Transuranic Storage Area and Retrieval Enclosure. In addition, the AMWTF at TSA is under construction by BNFL, Inc. with planned completion in 2002.

Operations at the AMWTF are scheduled to begin in 2003. A major part of that facility's mission is to retrieve and treat 65,000 m^3 (2.3 million ft^3) of INEEL low-level and transuranic waste currently stored at TSA. The waste will be prepared for shipment to New Mexico's Waste Isolation Pilot Plant or a low-level disposal site in accordance with the Settlement Agreement between the State of Idaho, the DOE, and the Navy (DOE 1995).

The TSA has been supporting the Waste Isolation Pilot Plant during an experimental test program that will demonstrate compliance of the plant with federal regulations. As part of testing, waste was retrieved from the TSA and was examined at the Stored Waste Examination Pilot Plant and ANL-W. Shipping via the Transuranic Package Transporter II is being implemented to support shipments to the Waste Isolation Pilot Plant.

Expanding current boundaries of the RWMC may be necessary as remedial decisions are reached for WAG 7 and project planning focuses on remedial design and remedial action. During remediation, lay-down areas for construction and site access will be needed. In addition, because a cap will be built over the SDA (DOE-ID 1998), the site boundary will likely be expanded to allow construction of a cap that extends beyond the current fence line and to establish a buffer zone around the cap. Furthermore, long-term stewardship will be required at the RWMC to maintain the cap, monitor the site, and restrict access to residual contamination. These issues will be addressed in the record of decision for OU 7-13/14.

2.7 Cultural Resources

Undisturbed sagebrush rangelands and developed facilities found on the INEEL contain thousands of sensitive cultural resources reflecting human use of the region for a period in excess of 12,000 years. Sites such as Aviators' and Middle Butte Caves, Goodale's Cutoff of the Oregon Trail, and Experimental Breeder Reactor-I are relatively well-known examples of the rich human heritage that is preserved there and literally thousands more exist. The RWMC has been an important element in the INEEL historical landscape since the early 1950s when construction of the original disposal facility began. The sections below provide an overview of the cultural resources at the INEEL followed by the specific resources at the RWMC.

2.7.1 Cultural Resources Overview

The DOE has developed a written policy (DOE 2001) that helps ensure compliance with the spirit and intent of the legislative mandates that form the basis for managing cultural resources. Through site-specific policies (e.g., Manual 8, ***Environmental Protection and Compliance),*** management plans (Braun et al. 2000), and procedures (MCP 3480, "Environmental Instructions for Facilities, Processes, Materials and Equipment"), and in consultation with the Idaho State Historic Preservation Office, DOE-ID integrates cultural resource management into missions and activities of the INEEL. Archaeological or architectural evaluations and Native American consultation conducted in advance of all proposed ground disturbance and monitoring of known resources also help to ensure that ongoing environmental cleanup and restoration activities do not have adverse effects on known archaeological sites and historic buildings.

Cultural resource management has been ongoing at the INEEL for more than 40 years (Braun et al. 2000). In that time, approximately 7.5% (17,461 hectares [43,145 acres]) of the undeveloped portion of the 2,305 km^2 (890 mi^2) within the INEEL has been systematically surveyed, local tribal people whose aboriginal homelands included the INEEL have been consulted, and the main buildings under DOE-ID jurisdiction have been evaluated. As a result of these efforts, a variety of cultural resources have been identified:

- Archaeological sites
- Contemporary Native American cultural resources
- Historic architectural properties
- Paleontological sites.

More than 1,900 archaeological sites have been identified during cultural resource surveys at the INEEL. Approximately 95% of this inventory consists of campsites, lithic scatters, and rock features from the prehistoric period (12,000 to 150 years ago). A preliminary predictive model suggests that as many as 75,000 additional resources of these types may be undiscovered within the boundaries of the INEEL (Ringe 1995). A smaller proportion of the known archaeological resource inventory includes sites that reflect more recent activities including homesteads, old canals and canal construction camps, emigrant trails, stage stops, and railroad sidings from the late 19" and early 20" centuries. Because the INEEL area has seen only limited public access for the past 50 years, many of these sites, prehistoric and historic alike, are remarkably well preserved. More than half of the archaeological resources currently identified at the INEEL are considered to be potentially eligible for nomination to the National Register of Historic Places.

Far less is known about the nature and distribution of Native American cultural resources at the INEEL. However, ongoing consultation and cooperation under the Agreement in Principle between DOE-ID and the Shoshone-Bannock Tribes (DOE-ID 2000b) have shown that many archaeological sites in the region are ancestral and important to tribal culture. Natural landforms and native plants and animals of the northeastern Snake River Plain also are of sacred and traditional importance and, though rare, human burials are of special concern. Investigations of these types of INEEL cultural resources are ongoing (Shoshone-Bannock Tribes 2000). Again, because a large portion of the INEEL area remains undeveloped, cultural resources of this type remain largely undisturbed.

Historically significant cultural resources are located in the developed portion of the INEEL. These resources include buildings, structures, and objects that have made significant contributions to the broad patterns of American history through their association with World War II, the Cold War, and important advances in science and technology (Stacey 2000). Preliminary results from a 1997 architectural survey of INEEL buildings indicate that at least 191 of the 499 buildings surveyed are potentially eligible for nomination to the National Register either individually or as contributing elements of a historic district (Arrowrock 1997). In addition, the remaining buildings contribute to the overall INEEL historic landscape. As discussed in Section 2.1, one INEEL nuclear facility, the Experimental Breeder Reactor I, is listed as a national historic landmark.

A relatively small number of paleontological sites are included in the cultural resource inventory of the INEEL. Though these resources do not directly imply human activity in the region, they often provide important climatic and environmental background information. Approximately 25 sites of this type have been identified, including 17 with vertebrate remains (Miller 1995).

2.7.2 Radioactive Waste Management Complex Cultural Resources

All four major types of INEEL cultural resources—archaeological sites, contemporary Native American cultural resources, historic architectural properties, and paleontological sites (see Section 2.7.1)—have been identified in the RWMC area during previous cultural resource investigations. Ten major archaeological survey projects identified an inventory of 13 potentially significant prehistoric sites within a 200-m (656-ft) -wide zone surrounding the fenced perimeter of the facility and more than 80 additional archaeological resources in the surrounding area. Paleontological remains have been identified in excavations within the facility. Shoshone-Bannock tribal members have been consulted about additional resources of Native American concern during at least two tours of the area. In addition, as a result of architectural surveys of 55 DOE-ID administered buildings within the developed portion of the RWMC three buildings, the Waste Management Facility (WMF) -601, WMF-610, and WMF-612, may be eligible for nomination to the National Register. Additional details on these resources are provided below.

Archaeological inventories near the RWMC began in 1971 when students under the direction of B. R. Butler examined a 549-m (1,800-ft) zone surrounding the original facility perimeter fence (Butler 1971). No significant cultural resources were identified during this project. In 1984, S. J. Miller (1984) invalidated Butler's negative findings by recording a number of prehistoric archaeological sites in the RWMC area. Systematic surveys conducted by Idaho State University in 1984, 1985, 1987, 1988, and 1990, and by the INEEL Cultural Resource Management Office in 1993 and 1999 further established the archaeological sensitivity of the area (Reed et al. 1987; Wright and Holmer 1987; Ringe 1988; Sammons-Lohse and Holmer 1990; Ringe 1993; Pace 1999). The current known inventory of archaeological resources near the RWMC includes isolated artifacts, stone tool modification sites, hunting camps, extended camps, and stone features from the prehistoric period (12,000 to 150 years ago) as well as Oregon Trail remnants, stage stations, homesteads, early town sites, and canals from historic times (150 to 50 years ago). Nearly all archaeological resources near the RWMC exhibit potential for future scientific research.

To allow for limited expansion of RWMC-related activities, test excavations have been completed at three of the archaeological sites located very near the RWMC perimeter fence (Ringe 1992a, 1992b, 1992c). As a result of this work and consultation with the Idaho State Historic Preservation Office, one prehistoric archaeological site has been determined ineligible for nomination to the National Register (Yohe 1995). The twelve additional sites located within 200 m (656 ft) of the facility fence remain unevaluated and are considered to be potentially eligible for nomination. This also is true of the more than 80 archaeological resources located in a wider perimeter around the facility. However, given the high degree of ground disturbance within the fenced perimeter of the RWMC, the Idaho State Historic Preservation Office has agreed that little potential exists for undisturbed archaeological materials and has recommended clearance for ongoing and future ground disturbance (Yohe 1993). However, all work at the INEEL is subject to strong stop-work stipulations in the event that cultural materials are discovered during project implementation.

Vertebrate paleontological remains have been reported in three separate instances during excavations within the deep sediments that underlie RWMC facilities (Miller 1995). All are Pleistocene in age (3 million to 10,000 years ago) and are not associated with cultural artifacts. Two of the finds, a horse metapodial and an unidentified megafaunal element, were discovered 4.6 to 4.9 m (15 to 16 ft) below existing ground surface, while a sandy lens approximately 1 to 2.4 m (3 to 8 ft) below existing ground surface yielded mammoth remains.

As stakeholders concerned about the preservation of cultural resources at the INEEL, Shoshone-Bannock tribal members have toured the RWMC area on at least two occasions.[c,d] Tribal members have clearly indicated that all archaeological sites in the RWMC vicinity are of tribal importance.

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